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QC100 .U556 V35-39;1961-62 C.1 NBS-PUB-C

NBS MONOGRAPH 35

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Bibliography and Index on Vacuum and Low Pressure Measurement



U.S. DEPARTMENT OF COMMERCE
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UNITED STATES DEPARTMENT OF COMMERCE • Luther H. Hodges, *Secretary*
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Bibliography and Index on Vacuum and Low Pressure Measurement

W. G. Brombacher



National Bureau of Standards Monograph 35

Issued November 10, 1961

National Bureau of Standards

JUN 2 1965

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Foreword

Preparation of this bibliography and index on vacuum and low pressure was undertaken to fill the need of scientists, engineers, and other users for sources of information. It was originally planned to include a critical review of vacuum and low pressure measurement with the bibliography. In order to avoid undue delay in the publication of the bibliography it was found advisable to omit the review which, however, will be prepared for separate publication.

This bibliography was prepared as part of the work on vacuum standards which is now in progress in the Mechanics Division under the supervision of D. P. Johnson, Chief of the Pressure and Vacuum Section.

A. V. Astin, Director,

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BIBLIOGRAPHY AND INDEX ON VACUUM AND LOW PRESSURE MEASUREMENT

W. G. Brombacher

The bibliography contains 1538 references, of which 52 are on books. About 550 of the periodical references are specifically on pressure measurement including both vacuum gages and micromanometers. The balance are on vacuum technology, including adsorption, degassing, vacuum pumps, controlled gas leaks, valves, seals and vacuum systems, all of which bear on the technique of vacuum measurement. The indices consist of an author index and an index of the subject matter of the listed references.

1. INTRODUCTION

Vacuum technology has been advancing at a rapidly accelerating rate during the past few years in response to the needs of science and industry. To meet the need for means of locating technical information, abstracts of current literature on vacuum technology are available in a number of the publications. Notable among those specifically on vacuum technology are: a) Vacuum (since 1951), The international journal and abstracting service for vacuum science and technology. Pergamon Press, London. b) Le Vide (since 1946), Société Française des Ingénieurs des Techniciens du Vide, Paris, France. Other abstract journals or publications containing a significant number of abstracts on vacuum measurement include c) Physical abstracts, Section A of Science abstracts, Institution of Electrical Engineers, London. d) Chemical abstracts, American Chemical Society, Columbus, Ohio. e) Engineering index, Engineering Societies, New York. f) Physikalische Berichte, Deutsche Gesellschaft für technische Physik, Braunschweig.

Excellent surveys of vacuum measurement are given in Dushman's "Scientific foundations of vacuum technique" (1949) and in Leck's "Pressure measurement in vacuum systems" (1957) but the references are incomplete and do not include the flood of papers published since. The preparation of an up-to-date bibliography, undertaken here, appears to fill a need for a source of readily available information. This paper consists essentially of a) a bibliography, b) an author index, and c) an index of the subject matter of the bibliography. While the primary objective is to focus on vacuum measurement, it was believed essential to include in the bibliography articles on vacuum technology in some measure accessory or essential to vacuum measurement. For maximum usefulness, an index of the subject matter of the references has been prepared. The abstract publications listed in the previous paragraph have been freely drawn upon in preparing the bibliography.

Neither surveys nor bibliographies appear to be available on micromanometers, covering absolute pressure measurements just above the high vacuum range or on sensitive, small differential pressure

measurement. This instrumentation is of interest principally to workers in scientific and industrial laboratories. References to micromanometers are listed in the bibliography and are indexed similarly as described in the preceding paragraph.

It was originally planned to include a critical review of vacuum and low pressure instrumentation with emphasis on possible standard instruments and on calibration methods. Preparing and including this review would delay publication unduly. Since the bibliography and indices will adequately meet the needs of many of those interested in the field, it was decided to issue the bibliography as promptly as possible. The review will be prepared and issued separately.

Standard vacuum terminology has been proposed by the American Vacuum Society [58148] and the British Standards Institution [58104]. In the subject index the American proposed classification of degrees of high vacuum has been adhered to. This is

Condition	Pressure range, Torr
High vacuum	10^{-3} to 10^{-6}
Very high vacuum	10^{-6} to 10^{-9}
Ultra-high vacuum	10^{-9} and below

The Torr equals 1/760 of an atmosphere of pressure (1013.250 millibars) or at pressures in the vacuum range, one millimeter of mercury for all practical purposes.

The term micromanometers is rather generally used to designate designs of liquid or mechanical type pressure measuring instruments which are an order more sensitive than designs considered more or less standard. More specifically, micromanometers may be defined as instruments of the liquid or mechanical type used to measure absolute or differential pressure in the range from about 10^{-4} to 10 mm of mercury, with the ability to detect pressure changes of less than about 0.01 mm of mercury. It also includes water or oil manometers used to measure differential pressure, with a pressure change of less than about 0.01 inch of water detectable.

2. BIBLIOGRAPHY

The references are divided into a list of books and a list of papers and reports, all listed chronologically, by years. Books are designated by the letter "B" followed by two digits indicating the year of publication and by a single digit identifying the order of listing. For example B592 indicates a book published in 1959, listed second in the book list. Papers and reports are designated by four digits or five, where necessary, the first two indicating the year of publication or issue, and the last two or three the order of listing. Thus 58122 indicates 122d in the list for 1958.

The bibliography contains 1538 references, of which 52 are books. About 550 of the periodical references are specifically on pressure measurement. The period covered is up to January 1, 1961.

A reasonable effort was made to list all significant references on vacuum and low pressure instrumentation, particularly those published since 1949. Extensive, but not necessarily complete,

references to vacuum technology and phenomena were included, since making valid vacuum measurements involve the effect of such phenomena as adsorption, degassing etc. References are therefore included on adsorption, degassing, outgassing, surface reaction, mechanical and diffusion pumps, leak detection, controlled gas leaks, and on hardware such as seals, valves, gaskets and vacuum systems. References on methods of calibrating vacuum gages and on standards of measurement are also listed.

Papers on micromanometers, both liquid and mechanical types, are listed. The criterion for inclusion of those measuring absolute or differential pressure is stated in the Introduction.

With minor exceptions neither catalogs, nor announcements in trade journals of new instruments without technical data, nor patents, are listed. Papers covering applications of vacuum technology are of necessity omitted, unless of some significance in vacuum measurement.

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4. SUBJECT INDEX

The subject index covers the material in the references as completely as possible, based mostly on a perusal of the reference, in some cases on an abstract and rarely only on the title.

The headings require some discussion. Out-gassing and degassing are indexed under "Degassing" for convenience, since the phenomena are in many cases too closely related to be easily separated. For the same reason, papers on permeability and diffusion are indexed under "Diffusion of gases".

Gettering action has been covered under five headings: "Getters," under which gettering materials are covered; "Ion pumps" and "Getter-ion pumps," under which specific designs are covered; "Gettering action, ionization gages," the importance of which seemed to warrant a separate heading; and last, "Clean-up of gases, electrical," under which gettering action not otherwise covered is indexed.

Micromanometers cover the class of low pressure

instrumentation which it is desired to discuss. Two headings are used, "Micromanometers, liquid type" and "Mechanical pressure and vacuum gages." The latter heading is preferable to "Micromanometers" because many designs of mechanical micromanometers have possible application to the vacuum range.

Finally, a distinction has been made between gaskets and seals. Mainly the design or physical properties of the gaskets are covered under "Gaskets," and the application and assemblies under "Seals."

In using the index, note that under the heading "Pressure measurement" all types of vacuum gages and micromanometers are listed under the various nomenclatures in use, with a reference to the heading under which it may be located in the index. The same has been done for pumps under the heading "Pumps."

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